

CAREER: Ferroelectric Multilayers, Superlattices, and Compositionally Graded Films

DMR-0132918

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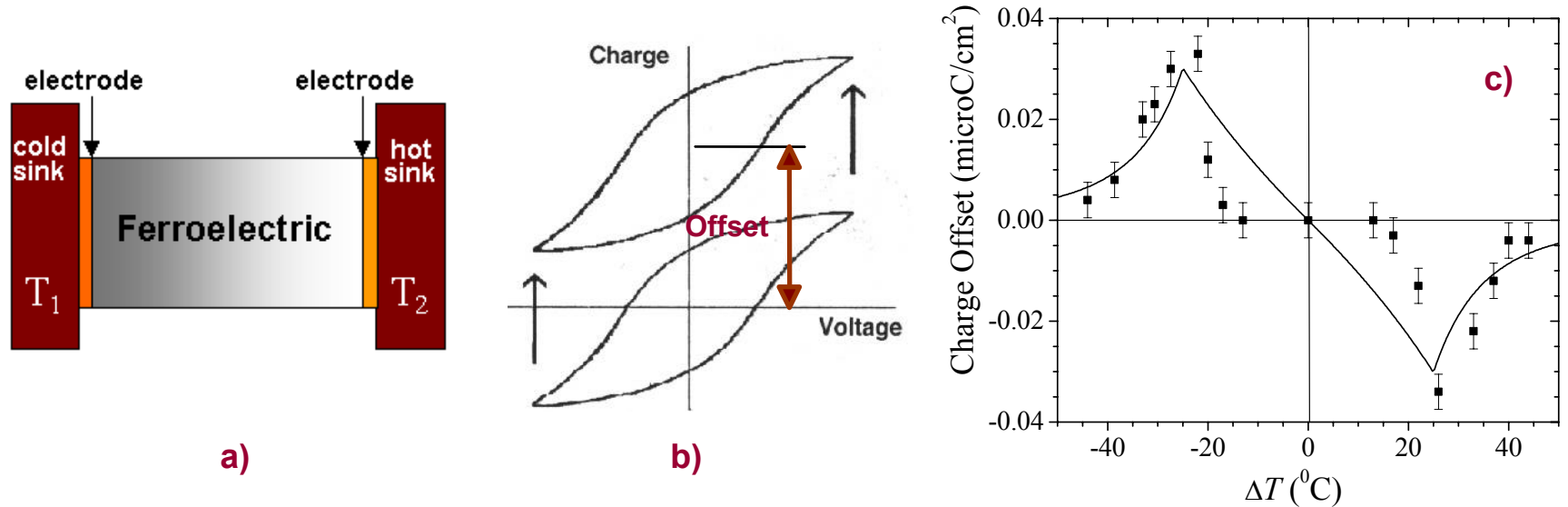


Figure 1. a) BaTiO₃-SrTiO₃ solid solution between two electrodes with a temperature gradient established across the ferroelectric bar, b) schematic response to an applied electric field across the electrodes compared to a homogeneous ferroelectric: the charge offset, c) experimentally measured and theoretical charge offset for BaTiO₃-SrTiO₃ as a function of the temperature gradient $\Delta T = T_2 - T_1$.

Research:

Graded ferroelectric materials may have potential applications due to enhanced infrared detection, actuation, and energy storage capabilities associated with a “built-in” field resulting from the charge offset. For example, a homogeneous ferroelectric material subjected to a temperature gradient (Fig. 1a) develops an offset in the charge on the electrodes vs. applied voltage across the electrodes behavior (Fig. 1c). This offset has been measured and theoretically modeled for BaTiO₃-SrTiO₃ ceramics. The model was extended as to include compositionally graded and strain-graded ferroelectrics. The developed model enables us to optimize desired properties by materials selection, controlling the extend of grading, and by adjusting the internal stresses.

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Education:

During the past two years, 6 undergraduate students (Mr. Dean Halter, Mr. Scott Virkler, Mr. Michael White, Ms. Sofia Iddir, Ms. Elisabeth Jordan, and Ms. Zoe Weber) and 3 graduate students (Mr. Z.-G. Ban, Mr. A. Sharma, and Mr. I.B. Misirlioglu) contributed to this program. Ban received his Ph.D. in 2003 and is presently a post-doc in our group at the University of Connecticut.

Graduate students presented their work at international conferences (6 invited, 12 contributed presentations).

Outreach:

A popular science web site on the science and technology of thin film materials was developed and uploaded thanks to the efforts of Mr. Halter, Mr. White, Mr. Virkler, and Ms. Weber. They have worked not only on the design of the web pages but on the content as well.

